WHAT IS CLAIMED IS:

Sub B1

1. An integrated circuit, comprising:

a silicon substrate;

an insulating layer formed on an upper surface of the substrate wherein a contact opening is formed in the insulating layer, wherein the contact opening extends from an upper surface of the insulating layer to the upper surface of the substrate;

a conductive contact deposited in the opening in a manner such that the conductive contact directly contacts the upper surface of the substrate, wherein the conductive contact comprises a titanium layer interspersed with titanium silicide;

a conductive contact fill deposited on an upper surface of the conductive contact in a manner such that the contact fill fills substantially the entire contact opening, wherein the contact fill comprises titanium nitride.

2. The integrated circuit of Claim 1, wherein the titanium layer interspersed with titanium silicide is approximately 50Å to 150Å thick.

3. The integrated circuit of Claim 1, wherein the titanium layer interspersed with titanium silicide comprises approximately 10 % silicon.

4. The integrated circuit of Claim 1, wherein the contact opening has an aspect ratio of at least 10:1.

5. The integrated circuit of Claim 1, wherein the upper surface of the substrate comprises a junction region.

6. The integrated circuit of Claim 5, wherein the junction region is less than about 1μm deep.

7. The integrated circuit of Claim 5, wherein the titanium silicide in the titanium layer provides low resistance electrical contacts between the junction region and the silicon substrate.

8. The integrated circuit of Claim 1, wherein the titanium rich titanium silicide layer is deposited over the upper surface of the insulating layer.

9. The integrated circuit of Claim 1, wherein the titanium nitride contact fill comprises a $TiCl_4$ based titanium nitride.

Sub B2

10. A contact structure having a contact opening formed over a junction region in a silicon substrate, comprising:

a conductive contact layer comprising titanium interspersed with titanium silicide, wherein the conductive contact layer is deposited directly on an upper surface of the silicon substrate over the junction region, wherein the titanium silicide in the conductive contact layer reduces consumption of silicon from the junction region during a silicidation reaction between silicon in the substrate and titanium in the conductive contact layer;

a diffusion barrier layer formed on an upper surface of the conductive contact layer;

a contact fill formed on an upper surface of the diffusion barrier layer, wherein the contact fill comprises titanium nitride, wherein the titanium nitride fills substantially the entire contact opening.

11. The contact structure of Claim 10, wherein the junction region is less than about 1μm deep.

12. The contact structure of Claim 11, wherein the diffusion barrier layer comprises titanium nitride.

13. The contact structure of Claim 11, wherein the titanium interspersed with titanium silicide layer is deposited using a PECVD process.

14. The contact structure of Claim 13, wherein the titanium interspersed with titanium silicide layer is deposited using a gas mixture comprising $TiCl_4$, Ar, H_2, He, and SiH_4.

15. The contact structure of Claim 14, wherein the titanium interspersed with titanium silicide layer is deposited at a process temperature of about 650°C, RF power of about 400 W, and pressure of about 4 Torr.

16. The contact structure of Claim 15, wherein the titanium interspersed with titanium silicide layer is deposited by adding about 10 sccm of SiH_4 at about 400 W.

17. The contact structure of Claim 11, wherein the titanium nitride contact fill is deposited using a CVD process.

18. The contact structure of Claim 18, wherein the titanium nitride contact fill is deposited using $TiCl_4$ and NH_3 precursors.

19. A method of fabricating a contact structure on a silicon substrate, comprising:

forming an insulating layer on an upper surface of the substrate;

forming an opening in the insulating layer, wherein the opening extends from an upper surface of the insulating layer to the upper surface of the substrate;

forming a titanium layer interspersed with titanium silicide in the opening wherein the titanium layer interspersed with titanium silicide directly contacts the upper surface of the substrate, wherein the titanium layer reacts with silicon in the substrate to form a titanium silicide layer, wherein the titanium silicide interspersed in the titanium layer reduces the consumption of silicon during the formation of the titanium silicide layer;

forming a conductive contact fill in the opening, wherein the conductive contact fill comprises titanium nitride deposited directly on the titanium silicide layer, wherein the titanium nitride fills substantially the entire opening.

20. The method of Claim 19, wherein forming the titanium layer interspersed with titanium silicide comprises using a PECVD process to deposit a silicon doped titanium layer on the upper surface of the substrate.

21. The method of Claim 20, wherein depositing the silicon doped titanium layer comprises using a gas mixture comprising $TiCl_4$, Ar, H_2, He, and SiH_4.

22. The method of Claim 21, wherein depositing the silicon doped titanium layer comprises depositing the layer at a temperature of about 650 C, RF power of about 400 W and pressure at about 4 Torr.

23. The method of Claim 22, wherein depositing the silicon doped titanium layer comprises adding about 10 sccm of SiH_4 to the gas mixture at about 400 W.

24. The method of Claim 19, wherein forming the conductive contact fill comprises depositing titanium nitride into the opening using a chemical deposition process.

25. The method of Claim 24, wherein depositing the titanium nitride comprises using a PECVD process.

26. The method of Claim 25, wherein depositing the titanium nitride comprising using $TiCl_4$ and NH_3 precursors.

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